IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Docket No.: 33965US1 (KDK)
MEIER, Paul F., et al.	Confirmation No.: 9187
Application No.: 10/821,161	Group Art Unit No.: 1764
Filed: April 7, 2004	Customer No.: 23589
DESULFURIZATION SYSTEM WITH ENHANCED FLUID/SOLIDS CONTACTING	Examiner: DOUGLAS, John C.

APPEAL BRIEF

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APPELLANT'S BRIEF ON APPEAL

In response to the final Office Action dated April 18, 2007, the Advisory Action dated September 9, 2007, and the Notice of Appeal dated September 18, 2007, Appellant's Brief on Appeal in accordance with 37 C.F.R. § 41.37 is hereby submitted. The Examiner's final rejections of claims 1-20 as last amended are herein appealed, and allowance of said claims is respectfully requested.

The Commissioner is hereby authorized to charge the requisite filing fee of $510.00 as required by 37 C.F.R. § 41.20(b)(2), as well as any additional fees which may be due in connection with this Appeal, or credit any overpayment, to our Deposit Account No. 19-0522.

Respectfully submitted,

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(Docket No.: 33965US1 (KDK))

Following are the requisite statements under 37 C.F.R. § 41.37:

I. Real Party in Interest

Paul F. Meier, Edward L. Sughrue, Jan W. Wells, Amos A. Avidan, Max W. Thompson, and Douglas W. Hausler are the inventors of the claimed invention. Paul F. Meier, Edward L. Sughrue, Jan W. Wells, Amos A. Avidan, Max W. Thompson, and Douglas W. Hausler have assigned all of their rights, title, and interest in the invention, application, and any Letters Patent issuing therefrom to Phillips Petroleum Company. This assignment was recorded in the United States Patent and Trademark Office at Reel 013033, Frame 0457.

The entire right, title, and interest in the invention, application, and any Letters Patent issuing therefrom was assigned from Phillips Petroleum Company to ConocoPhillips Company. This assignment was recorded in the United States Patent and Trademark Office at Reel 020006, Frame 0080.

The entire right, title, and interest in the invention, application, and any Letters Patent issuing therefrom was assigned from ConocoPhillips Company to China Petroleum & Chemical Corporation. This assignment was recorded in the United States Patent and Trademark Office at Reel 020245, Frame 0748. Therefore, China Petroleum & Chemical Corporation is the real party in interest.

II. Related Appeals and Interferences

No related proceedings, appeals, or interferences are known to the Appellant that may directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. Status of Claims

The present application was filed on April 7, 2004, with 34 claims, of which claims 1 and 21 were independent. In a first Amendment dated March 27, 2006, claims 21-34 were withdrawn from consideration as being directed to a non-elected species in response to a restriction requirement. In a subsequent Amendment dated February 2, 2007, claim 1 was amended. All pending claims were rejected in the Office Action dated April 18, 2007, which preceded this appeal. Therefore, claims 1-34 are currently pending, with claims 1 and 21 being independent, and claims 21-34 being withdrawn from consideration. The Examiner's rejection of independent claim 1 as last amended is herein appealed.

IV. Status of Amendments

All amendments submitted by the Appellant have been entered. No amendments have been filed subsequent to the Notice of Appeal dated September 18, 2007.

A Response dated August 17, 2007 was filed by the Appellant after the final Office Action dated April 18, 2007. The Examiner entered the Response dated August 17, 2007, and mailed an Advisory Action dated September 9, 2007, which indicated that the Response did not place the application in condition for allowance. It is noted that the Response dated August 17, 2007 did not contain any amendments to the claims. All claims remain as presented and finally rejected in the Office Action dated April 18, 2007.

V. Summary of Claimed Subject Matter

The claimed subject matter of independent claim 1 generally relates to a method for removing sulfur from hydrocarbon-containing fluid streams. It is known that high levels of sulfurs in hydrocarbon-containing streams, such as automotive fuels, are often undesirable for numerous reasons. (Specification, Page 1, Lines 6-9). Conventional processes for removing sulfur from such hydrocarbon-containing streams, however, have exhibited drawbacks. For example, hydrodesulfurization of cracked-gasoline tends to saturate olefins and aromatics in cracked-gasoline, thereby detrimentally reducing its octane number. (Specification, Page 2, Lines 3-6). Additionally, hydrodesulfurization of diesel fuel tends to improve the cetane, but with a large and undesirable cost in hydrogen consumption. (Specification, Page 2, Lines 10-12). The claimed embodiments of the present invention, therefore, are directed to a novel desulfurization process for obtaining improved results compared to those of the prior art.

The invention of independent claim 1 is a desulfurization process that includes introducing a gaseous hydrocarbon-containing fluid into a fixed fluidized bed reactor via a hydrocarbon inlet. (Specification, Page 5, Lines 16-23). The reactor defines a reaction zone and a disengagement zone. (Specification, Page 24, Lines 5-7, 19-21, Page 25, Lines 17-18; FIGS. 2-3). The disengagement zone is disposed above said reaction zone. (Specification, Page 25, Lines 17-23; FIG. 2). The disengagement zone is broader than the reaction zone. (Specification, Page 25, Line 23-Page 26, Line 5; FIG. 2). The reactor comprises a series of substantially horizontal, vertically spaced, cross-hatched baffle groups disposed in said reaction zone. (Specification, Page 26, Lines 6-20; FIGS. 3-4). The process also includes introducing a plurality of solid sorbent particles into said reaction zone via a sorbent inlet located below at least a portion of said baffle groups. (Specification, Page 24, Lines 7-9; FIGS. 2-4). The process further includes forming a fluidized bed of said sorbent particles in said reaction zone by causing said hydrocarbon-containing fluid to flow upwardly through said sorbent particles. (Specification, Page 25, Lines 5-7). The fluidized bed has a particle density of at least about 20 lb/ft^3. (Specification, Page 25, Lines 12-14). Finally, the process includes transferring sulfur from said hydrocarbon-containing fluid to said fluidized sorbent particles. (Specification, Page 17, Lines 8-14).

Thus, various claimed embodiments of the present invention provide advantages over conventional sulfur removal processes previously known in the art. Appellant also notes that the

page and line numbers from the specification cited above are for reference purposes only and should not be taken as a limitation on the support for, or scope of, the claimed subject matter. Support for the claimed subject matter may be found throughout the specification and drawing figures, and the page and line numbers cited above merely refer to exemplary portions of the specification.

VI. Grounds of Rejection to be Reviewed on Appeal

Independent claim 1 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,146,519 to Koves in view of U.S. Patent No. 5,914,292 to Khare and U.S. Patent No. 5,842,617 to Collins, with U.S. Patent No. 4,827,069 to Kushnerick incorporated by reference in U.S. Patent No. 5,842,617 to Collins.

VII. Argument

The Examiner finally rejected independent claim 1 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,146,519 to Koves (hereinafter "Koves") in view of U.S. Patent No. 5,914,292 to Khare (hereinafter "Khare") and U.S. Patent No. 5,842,617 to Collins (hereinafter "Collins"), with U.S. Patent No. 4,827,069 to Kushnerick (hereinafter "Kushnerick") incorporated by reference in Collins.

A. The Examiner's improper obviousness rejection under 35 U.S.C. § 103(a)

The Examiner has improperly rejected independent claim 1 as being unpatentable over the arbitrary and piecemeal combination of Koves in view of Khare and Collins, with Kushnerick incorporated by reference in Collins. As is discussed in greater detail below, the Examiner has not offered an adequate identification of an articulated reason supported by some rational underpinning as to why a person of ordinary skill in the art would have combined these references into the Examiner's piecemeal combination. Moreover, under the requisite proper consideration of the full disclosure of each of these references, the cited references themselves teach away from such a combination. Furthermore, such a proposed combination would unacceptably require a significant change in the principle of operation of both Koves, the principal reference, and Khare.

B. The law on establishing a proper obviousness rejection and the Examiner's burden in establishing a *prima facie* case of obviousness

Obviousness can be a problematic basis for rejection because the Examiner, in deciding that a feature is obvious, has the benefit of the applicant's own disclosure as a blueprint and guide. In such illuminating light, even an exceedingly complex solution may seem easy or obvious. In contrast, one with ordinary skill in the art at the time the invention was made would have no such guide. Furthermore, once an obviousness rejection has been made, the applicant is in the exceedingly difficult position of having to prove a negative proposition (*i.e.*, non-obviousness) in order to overcome this rejection.

For these reasons, the law places upon the Examiner the initial burden of establishing a *prima facie* case of obviousness. The Examiner has the initial burden of presenting a *prima facie* case of unpatentability, whether based on prior art or any other ground. *See In re Oetiker*, 977

F.2d 1443, 1445, 24 U.S.P.Q.2d 1443 (Fed. Cir. 1992). If the Examiner fails to establish the requisite *prima facie* case, the rejection is improper and will be overturned. *In re Rijckaert*, 9 F.3d 1531, 1532, 28 U.S.P.Q.2d 1955 (Fed. Cir. 1993). "If the PTO fails to meet this burden, then the applicant is entitled to the patent." *In re Glaug*, 283 F.3d 1335, 1338, 62 U.S.P.Q.2d 1151 (Fed. Cir. 2002). Only if the Examiner satisfies the initial burden of establishing a proper *prima facie* case of obviousness does any burden then shift to the applicant to overcome such a properly formed *prima facie* case with argument and/or evidence. *See In re Kumar*, 418 F.3d 1361, 1366, 76 U.S.P.Q.2d 1048 (Fed. Cir. 2005).

In meeting this vital initial burden, the Examiner "cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." *In re Fine*, 837 F.2d 1071, 1075, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). Similarly, it "is impermissible ... to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art." *In re Wesslau*, 353 F.2d 238, 241, 147 U.S.P.Q. 391 (C.C.P.A. 1965). Thus, the Examiner is required to perform the "critical step" of casting his or her mind back to the time of the invention, to consider the thinking of one or ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field. *See, e.g., W. L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 U.S.P.Q. 303 (Fed. Cir. 1983).

It is also critical that the Examiner provide explicit reasoning underlying an assertion of obviousness. As the United States Supreme Court has recently reiterated, the analysis of the interrelated teachings of the prior art references used in a rejection "should be made explicit." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. ___, No. 04-1350, slip op. at 14, 2007 WL 1237837 (2007). To this end, the Federal Circuit has made clear that "rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some *articulated reasoning* with some *rational underpinning* to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988, 78 U.S.P.Q.2d 1329 (Fed. Cir. 2006) (emphasis added) (cited with approval in *KSR Int'l Co.*, 550 U.S. at ___, slip op. at 14). The factual inquiry performed by the Examiner in issuing an obviousness rejection must be thorough and searching. *McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 1351-52, 60 U.S.P.Q.2d 1001 (Fed. Cir. 2001). The prohibition against conclusory examination "is as much rooted in the Administrative Procedure

Act, which ensures due process and non-arbitrary decision-making, as it is in [35 U.S.C.] § 103." *In re Kahn*, 441 F.3d at 988.

As the United States Supreme Court recently reiterated in *KSR Int'l Co.*, the Court "set out a framework for applying the statutory language of [35 U.S.C.] § 103" in the landmark case of *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 148 U.S.P.Q. 459 (1966). *KSR Int'l Co.*, 550 U.S. at ___, slip op. at 2. Confirming that the test is "objective," the Court presented what have become known as the *Graham* factors:

> "Under [35 U.S.C.] § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unresolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented."

KSR Int'l Co., 550 U.S. at ___, slip op. at 2, *quoting Graham*, 383 U.S. at 17-18. The Court also proffered a reminder that although "the sequence of these questions might be reordered in any particular case, the factors continue to define the inquiry that controls." *Id.*

The Court also favorably discussed *United States v. Adams*, 383 U.S. 39, 50-51, 148 U.S.P.Q. 479 (1966) (a companion case to *Graham*), and clarified that when using elements known in the field, "the combination must do more than yield a predictable result." *KSR Int'l Co.*, 550 U.S. at ___, slip op. at 12, *citing Adams*, 383 U.S. at 50-51. Thus, "[t]he fact that the elements worked together in an unexpected and fruitful manner supported the conclusion that Adams's design was not obvious to those skilled in the art." *KSR Int'l Co.*, 550 U.S. at ___, slip op. at 12. The referenced case also provided the corollary principle that "when the prior art *teaches away* from combining certain known elements, discovery of a successful means of combining them is *more likely to be nonobvious*." *Adams*, 383 U.S. at 51-52 (emphasis added).

It is also "clear" that "a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *KSR Int'l Co.*, 550 U.S. at ___, slip op. at 14, *citing Adams*, 383 U.S. 39 (1966). Consequently, an Examiner's mere identification in the prior art of each individual element claimed is insufficient to defeat the patentability of a claimed invention without a specific and articulated reason that the combination simply produced known and expected results.

Additionally, the Federal Circuit has consistently held that "[t]he mere fact that the prior art *may be modified* in the manner suggested by the Examiner does not make the modification obvious unless the prior art *suggests the desirability* of the modification." *In re Fritch*, 972 F.2d 1260, 1266, 23 U.S.P.Q.2d 1780 (Fed. Cir. 1992) (emphasis added); *see also In re Gordon*, 733 F.2d 900, 902, 221 U.S.P.Q. 1125 (Fed. Cir. 1984). Such desirability of making the claimed combination must be found in the prior art, not in the applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 490, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). Moreover, if the Examiner's proposed combination renders the prior art invention unsatisfactory for its intended purpose, *or changes its principal of operation*, there can be no suggestion or motivation to form the combination—and thus, no *prima facie* case of obviousness. *See* MPEP § 2143.01; *In re Gordon*, 733 F.2d at 902.

In addition to an identified "reason" required by *KSR Int'l Co.*, establishment of a *prima facie* case of obviousness still requires a reasonable expectation of success in combining or modifying the prior art in the manner claimed. *See* MPEP § 2143.02. According to a decision by the Federal Circuit following *KSR Int'l Co.*, in order to establish obviousness, it must be shown that "a person of ordinary skill in the art would have had a reason to attempt to make the composition or device, or carry out the claimed process and would have had a *reasonable expectation of success* in doing so." *PharmaStem Therapeutics, Inc. v. Viacell, Inc.*, 491 F.3d 1342, 1360, 83 U.S.P.Q.2d 1289 (Fed. Cir. 2007), *citing Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1164, 77 U.S.P.Q.2d 1865 (Fed. Cir. 2006); *Noelle v. Lederman*, 355 F.3d 1343, 1351-52, 69 U.S.P.Q.2d 1508 (Fed. Cir. 2004); *Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1121, 56 U.S.P.Q.2d 1456 (Fed. Cir. 2000); *KSR Int'l Co.*, 550 U.S. at ___, slip op. at 12-13 (emphasis added). Whether a reasonable expectation of success exists is determined as of the time of the invention. *Ex parte Erlich*, 3 U.S.P.Q.2d 1011, 1986 WL 83564 (B.P.A.I. 1986).

Moreover, the ruling of the Unite States Supreme Court in *KSR Int'l Co.* did not change the fact that each and every element must be taught or suggested by the prior art in order to establish a *prima facie* case of obviousness. *KSR Int'l Co.*, 550 U.S. at ___, slip op. at 18 (addressing obviousness based on all elements of claim); *see also In re Zurko*, 258 F.3d 1379, 1385, 59 U.S.P.Q.2d 1693 (Fed. Cir. 2001) (reversing obviousness rejection where combined references failed to teach an element of the claimed invention); *Rockwell Int'l Corp. v. United States*, 147 F.3d 1358, 1365, 47 U.S.P.Q.2d 1027 (Fed. Cir. 1998) (reversing summary judgment

of invalidity based on obviousness where none of the prior art references alone taught a claim limitation, and the defendants failed to prove that the combination of references would suggest the missing limitation to one of ordinary skill in the art); *In re Royka*, 490 F.2d 981, 985, 180 U.S.P.Q. 580 (C.C.P.A. 1974) (obviousness rejection reversed where references taken together were still missing essential limitation of claimed invention); *Ex parte Kalliokulju*, 2007 WL 1378833 at *3 (B.P.A.I. May 10, 2007) (Not Written for Publication) ("Because we find the combination of Chen and Maggenti fails to teach or suggest all the limitations recited in the claim, we agree with Appellants that the Examiner has failed to meet the burden of presenting a *prima facie* case of obviousness."); MPEP § 2143.03.

Similarly, all words in the claim must be given effect in assessing the patentability of the invention over the prior art. MPEP § 2143.03; *In re Lowry*, 32 F.3d 1579, 1582, 32 U.S.P.Q.2d 1031 (Fed. Cir. 1994) ("The Patent and Trademark Office (PTO) must consider all claim limitations when determining patentability of an invention over the prior art."); *Ex parte Petersen*, 228 U.S.P.Q. 216, 217 (B.P.A.I. 1985) ("It is axiomatic that not only must claims be given their broadest reasonable interpretation consistent with the specification but also all limitations must be considered."); *Ex parte Scarpa*, 2003 WL 25283769 at *3 (B.P.A.I. Feb. 10, 2003) (Not Written for Publication) ("When evaluating claims for obviousness under [35 U.S.C.] § 103(a), all of the limitations recited therein must be considered and given weight, even those which do not find support in the specification as originally filed. *See* MPEP § 2143.03.")

C. The Examiner has failed to establish a proper *prima facie* case of obviousness for independent claim 1, as there is no reason why a person of ordinary skill in the art would combine Koves with Khare and Collins, with Kushnerick incorporated by reference in Collins, in the manner proposed by the Examiner

Appellant submits that the Examiner has failed to establish a proper *prima facie* case of obviousness with respect to independent claim 1 over Koves in view of Khare and Collins, with Kushnerick incorporated by reference in Collins. In particular, there is no adequate requisite articulated reason, supported by some rational underpinning, for combining and modifying these references in the manner used to reject independent claim 1 of the present application. Furthermore, the plain disclosure of the references, when taken in the required full context and consideration of what the reference teaches, expressly teaches away from such a combination.

Moreover, the proposed combination would improperly require a change in the principle of operation of these references. Thus, the Examiner's rejection of independent claim 1 cannot be sustained.

1. The Examiner has not provided an adequate articulated reason, explicitly stated with some rational underpinning, to combine and modify Koves with Khare, Collins, and Kushnerick

In the final Office Action of April 18, 2007, the Examiner notes that "Koves discloses a process for contacting hydrocarbon vapors with fluidized catalyst particles in a riser that comprises a series of redistribution sections." (Office Action of April 18, 2007, Page 3, Paragraph 2; Koves Specification, Col. 1, Lines 12-16, Col. 30, Lines 36-50, Col. 4, Lines 11-26, FIGS. 1 and 2). More particularly, Koves discloses a process of contacting hydrocarbon vapors with fluidized catalyst particles *in a transport riser*. (Koves Specification, Col. 1, Lines 12-16) (emphasis added). As will be readily appreciated by one of ordinary skill in the art, in a transport riser, the solid particles become entrained in the upwardly moving gas, flow through the riser with the moving gas, and exit the riser with the moving gas. Thus, it is clear that the reactor disclosed in Koves is not a "*fixed fluidized bed reactor*," as required for the novel process claimed in independent claim 1 of the presently claimed invention.

The reactor of Koves operates in a dilute phase regime. (Koves Specification, Col. 4, Lines 1-7). Again, as will be readily appreciated by one of ordinary skill in the art, several defining characteristics of a dilute phase regime include low particle densities, high gas velocities, and short residence times. Koves discloses that the "dilute phase catalyst regime is characterized by a lower mixture density" and that a typical "average mixture density in the dilute phase regime will be less than about 20 lb/ft^3." (Koves Specification, Col. 6, Lines 2-5).

Additionally, within the system of Koves, the particles "are accelerated up the conduit which produces a dilute phase mixture of particles and gas that flows through the riser." (Koves Specification, Col. 4, Lines 15-18). In fact, the "particles and gas in the dilute phase regime will have a higher superficial velocity," and it is "the higher velocities and the lower catalyst density that leads to the formation of the catalyst streamers or ribbons" that redistribution sections of Koves specifically aim to address. (Koves Specification, Col. 6, Lines 5-10). These operating conditions and flow behavior of the dilute phase regime of a transport riser of Koves are vastly

different from the operating conditions and flow behavior of the fixed fluidized bed reactor required by the process of the presently claimed invention.

Additionally, it is noted in the final Office Action of April 18, 2007 that

> Koves *does not disclose* where the gaseous feed contains a sulfur-containing hydrocarbon, *does not disclose* where the disengagement zone is broader the [*sic*] than the reaction zone, and Koves *does not disclose* transferring sulfur from the hydrocarbon to the fluidized sorbent particles. Koves does not exactly and expressly disclose where the fluidized bed has a particle density of at least about 20 lb/ft^3.

(Office Action of April 18, 2007, Page 3, Paragraph 3) (emphasis added). It is reemphasized that with particular respect to thc particle density used in the dilute phasc transport riser system disclosed in Koves, that not only does Koves not "exactly and expressly disclose where the fluidized bed has a particle density of at least about 20 lb/ft^3," as noted above, but Koves actually expressly discloses that the "density in the dilutc phase regime will be *less than about 20 lb/ft*^{3}." (Koves Specification, Col. 6, Lines 4-5) (emphasis added). Again, the process of the presently claimed invention requires "forming a fluidized bed of sorbent particles ... wherein said fluidized bed has a particle density of *at least about 20 lb/ft*^{3}."

In an effort to address these deficiencies by Koves, the Examiner looks to combine the dilute phase regime of a transport riser of Koves with the disclosure of Khare.

Khare discloses a process for removing hydrogen sulfide from fluid streams using a *transport desulfurization system*. (Khare Specification, Col. 2, Line 9) (emphasis added). As will be readily appreciated by onc of ordinary skill in thc art, the transport system of Khare (like that of Koves, above) is characterized by solid particles becoming entrained in the upwardly moving gas, flowing through the riser with the moving gas, and exiting the riser with the moving gas. Thus, it is again clear that the reactor disclosed in Khare is not a "*fixed fluidized bed reactor*," as requircd for the novel process claimed in independent claim 1 of the presently claimed invention.

In the final Office Action of April 18, 2007, the Examiner notes that "Khare discloses circulating a sorbent material with a stream containing sulfur and to remove sulfur from the fluid stream and that the disengagement zone is broader than the reaction zone." (Office Action of April 18, 2007, Page 3, Paragraph 4; Khare Specification, Col. 3, Lines 11-16, Col. 10, Lines 28-47, FIG. 2). The Examiner further notes that "Khare discloses that the removal of sulfur can be

necessary to meet sulfur emission requirements." (Office Action of April 18, 2007, Page 4, Paragraph 1; Khare Specification, Col. 1, Lines 23-27).

While the isolated disclosures of Khare noted by the Examiner may be true, they are also incomplete in a very significant respect. The reactor of Khare is a "transport reactor system," as opposed to a "fluidized bed" reactor system, such as the reactor of the presently claimed invention. This fundamental difference in reactor systems is even highlighted within the disclosure of Khare, where it notes "certain disadvantages" present in fluidized bed reactors. (Khare Specification, Col. 2, Lines 1-8). Khare next explains the advantages of its transport reactor system and disclosing that the sorbent used in the system of Khare must be "circulatable" such that it can be "conveyed within such fluidization zone against the force of gravity." (Khare Specification, Col. 2, Lines 9-24). Again, these operating conditions and flow behavior of the transport reactor of Khare are vastly different from the operating conditions and flow behavior of the fixed fluidized bed reactor required by the process of the presently claimed invention.

In addition, Khare teaches that its transport reactor operates in a dilute phase regime, similar to that of Koves, discussed above. Likewise, several defining characteristics of a dilute phase regime, as would be readily understood by one of ordinary skill in the art, include low particle densities, high gas velocities, and short residence times. Khare specifically discloses that the "average riser bed density was 6 lb/cu ft." (Khare Specification, Col. 15, Line 47). This is vastly different from the process of the presently claimed invention, which requires "forming a fluidized bed of sorbent particles ... wherein said fluidized bed has a particle density of *at least about 20* lb/ft^3." Thus, the disclosure of Khare, similar to that of Koves with respect to particle density, is expressly disclosed to be within a range that is outside of the particle density range of the fluidized bed required by independent claim 1 of the presently claimed invention.

After noting the disclosure from the drawings of Khare that the disengagement zone is broader than the reaction zone and that Khare teaches that the removal of sulfur can be necessary to meet sulfur emission requirements, the Examiner then simply states that

> it would have been obvious to one having ordinary skill in the art at the time of the invention to modify the process of Koves to include circulating a sorbent material with a stream containing sulfur and to remove sulfur from the fluid stream in order for a hydrocarbon to [meet] sulfur emission requirements.

(Office Action of April 18, 2007, Page 4, Paragraph 2). This conclusory statement for the combination of Koves in view of Khare lacks any of the necessary "articulated reasoning with

some rational underpinning" required for a proper *prima facie* case of obviousness, as clarified by *KSR Int'l Co.*, and discussed in more detail above. This arbitrary and conclusory combination was reiterated in the Advisory Action of September 9, 2007, when the Examiner stated that: "In the instant case, the teaching of the reacort [*sic*] of the present invnetion [*sic*] is provided by Koves in view of Khare." (Advisory Action of September 9, 2007, Page 2, Continuation Sheet).

There is simply no adequate reason given to combine these references in such a way. This conclusory statement neglects to consider the entire disclosures of both Koves and Khare, instead improperly picking and choosing isolated disclosures from the references without proper context of the fact that these references disclose reactive processes that operate in the dilute phase regime. The only hint of a reason given to combine these references, "in order for a hydrocarbon to [meet] sulfur emission requirements," can only be explained by improper hindsight reconstruction based on the Applicant's own disclosure.

Moreover, even the unmotivated combination of Koves and Khare constructed by the Examiner remains a disclosure only for a transport system, lacking the fixed fluidized bed or particle density range required by independent claim 1 of the presently claimed invention. In an effort to note disclosure of the required particle density range of the fluidized bed the Examiner cites to Collins.

Collins discloses a specific chemical process for desulfurizing a hydrocarbon stream and only notes that the "process of the instant invention operates in a dense fluid bed reactor." (Collins Specification, Col. 2, Lines 28-36, Col. 6, Lines 53-55). As noted in the final Office Action of April 18, 2007, the Examiner identifies that Collins discloses using a dense fluid bed reactor and that the "dense fluid bed reactor is disclosed by Kushnerick, which is incorporated by reference in Collins." (Office Action of April 18, 2007, Page 4, Paragraph 3; Collins Specification, Col. 31-34, 49-57). It is noted that these portions of the disclosure of Collins actually refer to Kushnerick to identify suitable catalysts, particle sizes, and distributions that could be used in a dense fluid bed, not a dense fluid bed reactor generally.

Kushnerick is incorporated by reference into the disclosure of Collins to identify suitable catalysts, particle sizes, and distributions that could be used in a dense fluid bed, as discussed above. This disclosure is used by the Examiner as evidence of catalyst density within the claimed range of the presently claimed invention. Kushnerick, though, discloses a petroleum refining process for "contacting a C_4^- fuel gas containing ethane and propene with a catalytic

reformate containing C_6 to C_8 aromatics over a fluidized bed of zeolite catalyst to convert the fuel gas to C_5^+ hydrocarbon gasoline and to convert the C_6 to C_8 aromatics to lower alkyl aromatic hydrocarbon gasoline." (Kushnerick Specification, Col. 1, Lines 15-23). There is no disclosure in Kushnerick, however, of a catalyst to be used in a desulfurization system.

The disclosure of Kushnerick is for a specific process, clearly different in purpose from the processes disclosed in the other references. The disclosed zeolite catalyst bed density of "preferably about 300 to 500 kg/m^3" is properly converted by the Examiner to a range of 19-31 lb/ft^3. (Kushnerick Specification, Col. 8, Line 67-Col. 9, Line 5); Office Action of April 18, 2007, Page 4, Paragraph 3). However, the density range of a particular catalyst used in a specific reaction cannot be simply lifted out of context to disclose a density range for a different catalyst in a hypothetical reactor made from the improper combination of very different references.

After noting these isolated disclosures of both Collins and Kushnerick, the Examiner then simply states that

> it would have been obvious to one having ordinary skill in the art at the time of the invention to modify the process of Koves to include a desulfurization method using a dense fluid bed reactor, having an average particle density of 19-31 lb/ft^3, because such a reactor is preferred to maintain catalyst activity.

(Office Action of April 18, 2007, Page 4, Paragraph 4). This indiscriminate combination was also reiterated in the Advisory Action of September 9, 2007, when the Examiner stated that: "the teachings of a dense bed are provided by Collins, which incorporates by reference, Kushnerick." (Advisory Action of September 9, 2007, Page 2, Continuation Sheet). As above, these conclusory statements for the combination of Collins and Kushnerick, both together and also with the improperly modified process of Koves, lack any type of required articulated reasoning with some rational underpinning. There is simply no adequate reason given to combine these references in such a way. The only suggestion of a reason given, "because such a reactor is preferred to maintain catalyst activity," is only disclosed within the specific system in Collins. It is an illogical jump to suggest that a similar preference exists within the systems of Koves or Khare, as these transport reactor systems are vastly different from the dense bed of Collins and nothing in those references suggests any desirability of such catalyst activity.

The Examiner also fails to consider the entire disclosure of Kushnerick, instead improperly picking and choosing one isolated disclosure regarding bed density of a different type of catalyst that happens to be within the range of the presently claimed invention. This is simply

not a sufficient basis for the establishment of a proper *prima facie* case of obviousness. Such conclusory statements merely, and improperly, pick and choose a particular density range, while improperly ignoring the entire disclosure of this reference. Kushnerick does not simply disclose a bed density suitable for any reactor; rather Kushnerick provides a specific density range that is suited for the particular process disclosed in that reference, notably not a desulfurization process.

The substitution of a dense fluid bed, such as that disclosed by Collins incorporating Kushnerick, with a bed density in the range of 19-31 lb/ft^3 would be outside the boundaries of the disclosed method of operation in even a hypothetical combination of Koves in view of Khare. The system of Koves could be rendered inoperable by the incorporation of a dense fluid bed into such a process. Accordingly, as discussed in detail above, there can be no *prima facie* case of obviousness. *See* MPEP § 2143.01; *In re Gordon*, 733 F.2d at 902.

Therefore, it is clear that the required identified reason with rational underpinning to combine the disclosures of Koves with Khare, Collins, and Kushnerick is simply not adequately provided. The Patent Office has provided detailcd guidelines with an extensive list of rationales to assist Examiners in making a proper obviousness determination, yet none are appropriately provided in this case. *See* MPEP § 2141, Part III (listing seven bases that "outline reasoning that may be applied to find obviousness"). Furthermore, in proper consideration of the full disclosures of these references, it is clear that a person of ordinary skill in the art at the time the invention was made would not be lead to make such a combination, as principles of operation of the reactive processes are vastly different. Only the Appellant's disclosure identifies the unique desulfurization process presently claimed, and only improper hindsight, using the Appellant's disclosure as a blueprint and guide, can explain the unmotivated combination of Koves with Khare, Collins, and Kushnerick used in the rejection of independent claim 1. Thus, this rejection must be reversed.

2. No rationally supported reason exists to combine and modify Koves with Khare, Collins, and Kushnerick in the manner proposed by the Examiner because Koves and Khare teach away from the combination with Collins or Kushnerick

As is discussed in greater detail in Section VII.B., above, it is well established that it is improper to combine references when the references teach away from their combination. As an example, a reference teaches away when a person of ordinary skill, upon reading the reference,

would be led in a direction divergent from the path that was taken by the applicant. *See In re Kahn*, 441 F.3d at 990. Here, both Koves and Khare disclose transport reactor systems wherein the average catalyst density is "less than about 20 lb/ft^3" and "6 lb/cu ft," respectively. (Koves Specification, Col. 6, Lines 2-5; Khare Specification, Col. 15, Line 47). The disclosure of Khare is even more illustrative, identifying and distinguishing the transport reactor of its system with fluidized bed reactors.

Specifically, Khare teaches that fluidized bed reactors "present certain disadvantages" such as "capital costs associated with the special equipment required for operating fluidized bed reactors" and "the need to use diluted air for regeneration of a used sulfur sorbent." (Khare Specification, Col. 2, Lines 1-9). Contrasted against these disadvantages, Khare teaches that it is preferred to use a transport reactor system "due to the lower capital costs associated with such system." (Khare Specification, Col. 2, Lines 9-11). It is additionally noted, however, that the benefits and effectiveness of a transport riser system are "substantially dependent upon the sorbent used in the system," which "must have the physical properties that make it circulatable." (Khare Specification, Col. 2, Lines 11-22). Thus, it is clear from the teachings of Khare that the properties of catalyst used in a transport riser system must be suited to such a system, as specifically disclosed above, and teaches away from the use of other catalyst properties.

Collins and Kushnerick, on the other hand, disclose dense bed reactors and Kushnerick specifically describes a catalyst bed density of "preferably about 300 to 500 kg/m^3," properly converted to a range of 19-31 lb/ft^3. (Kushnerick Specification, Col. 8, Line 67-Col. 9, Line 5). This higher density of the catalyst bed is the result of a direction divergent from the path taken by Koves and Khare.

A combination of these references, therefore, is improper. Accordingly, as discussed in more detail above, there can be no *prima facie* case of obviousness and the Examiner's rejection based on this improper combination cannot be sustained.

Therefore, in proper consideration of the full disclosures of these references, it is clear that a person of ordinary skill in the art at the time the invention was made would not be lead to make the combination relied upon by the Examiner, as the Koves and Khare references disclosing transport riser reactors specifically teach away from using the denser catalyst bed of the Collins and Kushnerick references. Only the Appellant's disclosure identifies the unique desulfurization process presently claimed, and only improper hindsight, using the Appellant's

disclosure as a blueprint and guide, can explain the unmotivated combination of Koves with Khare, Collins, and Kushnerick used in the rejection of independent claim 1. Thus, this rejection must be reversed.

3. No rationally supported reason exists to combine and modify Koves with Khare, Collins, and Kushnerick in the manner proposed by the Examiner because Khare teaches away from the combination with Koves

Again, as is discussed in greater detail in Section VII.B., above, it is well established that it is improper to combine references when the references teach away from their combination. As an example, a reference teaches away when a person of ordinary skill, upon reading the reference, would be led in a direction divergent from the path that was taken by the applicant. *See In re Kahn*, 441 F.3d at 990. Here, while the Examiner attempts to combine the disclosure of Khare with that of Koves, described above, it is specifically noted that Khare teaches away from such a combination.

Khare identifies that a "concern associated with the use of fluidizable materials is the attrition losses resulting from the fluidized particles colliding with each other and with the equipment walls which define a fluidization zone that contains the fluidized bed," noting that it "is desirable to keep attrition losses of the sorbent *as low as is possible*" during operation. (Khare Specification, Col. 1, Lines 58-63) (emphasis added). The reactor of Koves, on the other hand, includes redistribution sections to address the formation of catalyst streamers or ribbons. These redistribution sections include additional surfaces with which the particles collide. Thus, employing a combination of Koves with Khare would cause increased attrition of the sorbent particles and would frustrate Khare's goal of minimizing attrition loss. Thus, there is an express *disincentive* within the disclosure of Khare to combine its teachings with those of Koves.

Thus, it is clear that one of ordinary skill in the art at the time the invention was made, upon a review of the reactor disclosure of Khare, would be led in a direction divergent from the path of incorporating redistribution sections disclosed by the reactor of Koves. A combination of these references, therefore, is improper. Accordingly, as discussed in more detail above, there can be no *prima facie* case of obviousness and the Examiner's rejection based on this improper combination cannot be sustained.

Therefore, in proper consideration of the full disclosures of these references, it is clear that a person of ordinary skill in the art at the time the invention was made would not be lead to make the combination relied upon by the Examiner, as Khare teaches away from using the reactor of Koves. Only the Appellant's disclosure identifies the unique desulfurization process presently claimed, and only improper hindsight, using the Appellant's disclosure as a blueprint and guide, can explain the unmotivated combination of Koves with Khare used in the rejection of independent claim 1. Thus, this rejection must be reversed.

4. No rationally supported reason exists to combine and modify Koves with Khare, Collins, and Kushnerick in the manner proposed by the Examiner because such a combination would improperly require a fundamental change in the principle of operation of Koves and Khare

As is discussed in greater detail in Section VII.B., above, it has been consistently held that if the Examiner's proposed combination renders the prior art invention unsatisfactory for its intended purpose, *or changes its principal of operation*, there can be no suggestion or motivation to form the combination—and thus, no *prima facie* case of obviousness. *See* MPEP § 2143.01; *In re Gordon*, 733 F.2d at 902. In this case, it is specifically noted that the Examiner's proposed piecemeal combination to "modify the process of Koves to include a desulfurization method using a dense fluid bed reactor," is improper as it *changes the principle of operation* of the process of Koves. (Office Action of April 18, 2007, Page 4, Paragraph 2).

The process of Koves operates in the dilute phase regime, characterized by low particle densities, high gas velocities, and short residence times. As identified above, the process of Koves specifies that the density in the dilute phase regime will be less than about 20 lb/ft^3. It is also noted that Khare, which the Examiner combines with Koves, specifically discloses that the average riser bed density was 6 lb/ft^3. Thus, even assuming *arguendo* that Koves is modified in view of Khare, the resultant process would still remain in the dilute phase regime with a bed density of *less than about 20* lb/ft^3.

The substitution of a dense fluid bed, such as that disclosed by Collins incorporating Kushnerick, with a bed density in the range of 19-31 lb/ft^3 would be outside the boundaries of the disclosed method of operation in even a hypothetical combination of Koves in view of Khare. The system of Koves, or even the hypothetical combination of Koves in view of Khare, could likely be rendered inoperable by the incorporation of a dense fluid bed into such a process. It is

clear from a full understanding of the teachings of Koves and Khare that there is no desirability for such a modification. Moreover, to change the process of Koves, or even the hypothetical combination of Koves in view of Khare, from the disclosed transport reactor system operating in the dilute phase regime to dense fluid bed system would involve an unacceptably significant change in the principle of operation of both Koves, the principal reference, and Khare. Accordingly, as discussed in detail above, there can be no *prima facie* case of obviousness.

Therefore, in proper consideration of the full disclosures of these references, it is clear that a person of ordinary skill in the art at the time the invention was made would not be lead to make such a combination, as principles of operation of the reactive processes are vastly different. Only the Appellant's disclosure identifies the unique desulfurization process presently claimed, and only improper hindsight, using the Appellant's disclosure as a blueprint and guide, can explain the unmotivated combination of Koves with Khare, Collins, and Kushnerick used in the rejection of independent claim 1. Thus, this rejection must be reversed.

D. Conclusion

The Examiner has failed, with regard to the obviousness rejection of claims 1-20, to establish a proper *prima facie* case of obviousness for any of the rejected claims, as there is no sufficient explicit reasoning provided as to why a person of ordinary skill in the art would combine Koves in view of Khare and Collins, with Kushnerick incorporated by reference in Collins, to arrive at the Examiner's hypothetical combination. The required identified reason with rational underpinning to combine any of this collection of references is simply not adequately provided. In truth, such an adequate reason cannot be provided, as giving proper consideration to the full disclosure of each of these references, it is clear that a person of ordinary skill in the art at the time the invention was made would not be led to make such a combination. The references themselves teach away from such a combination, and the hypothetical combination crafted by the Examiner would improperly require a fundamental change in the principle of operation of the references.

It is only the Appellant's disclosure that identifies the unique desulfurization process presently claimed, and only improper hindsight, using the Appellant's disclosure as a blueprint and guide, can explain the unmotivated combination of Koves with Khare, Collins, and Kushnerick used in the rejection of independent claim 1. A person of ordinary skill in the art at

the time the invention was made, however, would not have such a guide, and would have no reason to combine prior art teachings in the hypothetical manner crafted by the Examiner in the rejection of independent claim 1 of the presently claimed invention. Appellant's claims, therefore, are novel and nonobvious.

Accordingly, for any or all of the deficiencies discussed in detail above, reversal of the Examiner's rejections is proper, and such favorable action is courteously solicited.

Respectfully submitted,

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(Docket No.: 33965US1 (KDK))

VIII. Claims Appendix

1. A desulfurization process comprising:

(a) introducing a gaseous hydrocarbon-containing fluid into a fixed fluidized bed reactor via a hydrocarbon inlet, wherein said reactor defines a reaction zone and a disengagement zone, wherein said disengagement zone is disposed above said reaction zone, wherein said disengagement zone is broader than said reaction zone, wherein said reactor comprises a series of substantially horizontal, vertically spaced, cross-hatched baffle groups disposed in said reaction zone;

(b) introducing a plurality of solid sorbent particles into said reaction zone via a sorbent inlet located below at least a portion of said baffle groups;

(c) forming a fluidized bed of said sorbent particles in said reaction zone by causing said hydrocarbon-containing fluid to flow upwardly through said sorbent particles, wherein said fluidized bed has a particle density of at least about 20 lb/ft^3; and

(d) transferring sulfur from said hydrocarbon-containing fluid to said fluidized sorbent particles.

2. The desulfurization process according to claim 1, wherein said solid sorbent particles have a mean particle size in the range of from about 20 to about 150 microns.

3. The desulfurization process according to claim 2, wherein step (c) includes causing said hydrocarbon-containing fluid to flow upwardly through said reactor at a superficial velocity in the range of from about 0.25 to about 5 ft/sec.

4. The desulfurization process according to claim 1, wherein said sorbent particles have a Group A Geldart Classification.

5. The desulfurization process according to claim 1, wherein step (c) includes causing a substantial portion of said sorbent particles to move above said sorbent inlet.

6. The desulfurization process according to claim 1, wherein step (c) includes forming a fixed fluidized bed of said sorbent particles in said reaction zone.

7. The desulfurization process according to claim 1, wherein said sorbent inlet is located below all of said baffle groups.

8. The desulfurization process according to claim 1, further comprising;

(e) withdrawing at least a portion of said sorbent particles from said reaction zone at a sorbent outlet located above said hydrocarbon inlet.

9. The desulfurization process according to claim 8, wherein said sorbent outlet and said sorbent inlet are both located below all of said baffle groups.

10. The desulfurization process according to claim 1, wherein each of said sorbent particles comprises nickel.

11. The desulfurization process according to claim 1, wherein each of said sorbent particles comprises zinc oxide, wherein step (d) includes converting at least a portion of said zinc oxide to zinc sulfide to thereby form sulfur-loaded sorbent particles.

12. The desulfurization process according to claim 11, further comprising;

(f) transferring at least a portion of said sulfur loaded sorbent particles from said reactor to a regenerator; and

(g) contacting said at least a portion of said sulfur loaded sorbent particles with an oxygen-containing regeneration stream in said regenerator to thereby convert at least a portion of said zinc sulfide to zinc oxide and provide oxidized sorbent particles.

13. The desulfurization process according to claim 12, further comprising;

(h) transferring at least a portion of said oxidized sorbent particles from said regenerator to a reducer; and

(i) contacting said at least a portion of said sulfur loaded sorbent particles with a hydrogen-containing regeneration stream in said reducer to thereby provide reduced sorbent particles.

14. The desulfurization process according to claim 13, further comprising;

(j) transferring at least a portion of said reduced sorbent particles from said reducer to said reactor for introduction into said reaction zone in accordance with step (b).

15. The desulfurization process according to claim 14, wherein said sorbent comprises a promoter metal component comprising nickel, wherein step (g) causes oxidation of said promoter metal component, wherein step (i) reduces the valence of said promoter metal component.

16. The desulfurization process according to claim 1, wherein each of said baffle groups includes a plurality of substantially parallelly extending laterally spaced elongated baffles, wherein said elongated baffles of adjacent ones of said baffle groups extend transverse to one another at a cross-hatch angle in the range of from about 60 to about 120 degrees.

17. The desulfurization process according to claim 16, wherein none of said elongated baffles of adjacent ones of said baffle groups extend parallel to one another.

18. The desulfurization process according to claim 16, wherein each of said elongated baffles is spaced from all other elongated baffles of the same baffle group.

19. The desulfurization process according to claim 1, wherein the height to width ratio of said reaction zone is in the range of from about 2:1 to about 15:1, wherein the height to width ratio of said fluidized bed is in the range of from about 2:1 to about 7:1.

20. The desulfurization process according to claim 1, wherein said hydrocarbon-containing fluid comprises a hydrocarbon selected from the group consisting of gasoline, cracked-gasoline, diesel fuel, and mixtures thereof.

IX. Evidence Appendix

None.

X. Related Proceedings Appendix

None.